

AMATEUR SATELLITE REPORT

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Editor: Vern Riportella, WA2LQQ
Contr. Editor: George Johnson, W0MD
Harold Winard, KB2M
Managing Editor: Bob Myers, W1XT

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Mysterious Mode B Shutdown Causes Concern

A baffling shutdown of AO-10, Mode B, late Friday, 30 Sept., swept concern for the health of the fledgling bird over the amateur satellite community. Alerted to the anomaly, spacecraft controllers in Europe and the U.S. were studying the problem at presstime. Although few facts have come to light at this juncture, authoritative sources suggest the problem is not a serious one; it does not bode ill for the longevity of AO-10. This much is known so far.

At 2128 UTC Friday, 30 Sept., AO-10 passed orbit phase (mean anomaly) 40. Normally the Mode B transponder would be keyed on by the software system at this point. The MA count of 40 occurs precisely 109.30 minutes after perigee. On Friday, however, the transponder did not appear as expected. W0RPK, AMSAT's AVP/OPS notified other AMSAT managers of the anomaly and the search was on for the cause.

On Saturday, DJ4ZC was likewise surprised by the unplanned shutdown. Karl communicated with the other AO-10 controllers via the telemetry system using the so-called M-Block.

M FROM DJ4ZC, 1.10.83: DURING THIS WEEK A SWITCHOVER OCCURRED TO BCR-2 AND THE TRANSPONDER SOFTWARE-FUSE TRIPPED YESTERDAY. AFTER RESETTING ALL IS OK. THE BCR MAY HAVE BEEN TRIGGERED BY STARTING ECLIPSES; PHIL, HW? THE TRANSPONDER FUSE COULD HAVE BEEN TRIGGERED BY T-PA OR U-BAT < 11 V; I INCREASED THE T TRIPPOINT FROM 40 TO 44C. TOMORROW TORQUING TO A NEW ATTITUDE WILL START AFTER TODAY'S RECAL. OF ALL THE NAV PARAMETERS. MODE L IS PLANNED FOR WED AND SAT APOGEES \pm 1 HOUR. 73's KARL

Thus DJ4ZC suggests that the Mode B may have been shutdown by a watchdog thermal sensor built into the Integrated Housekeeping Unit (IHU) to prevent damage from high temperatures. Karl's reference to eclipses and "Phil, HW?" refer to predictions of the eclipse season previously disseminated by Phil, KA9Q. Phil's table of eclipses for AO-10 showed a series of eclipses beginning mid-September. The parameter "T-PA" in the M-Block

refers to the Power Amplifier Temperature of the Mode B amplifier. Karl indicated he has increased the shutdown temperature to 44 C (111 F). The "BCR" is the Battery Charge Regulator.

Meanwhile JR1SWB reported that normal Mode B operations resumed at about 1215 UTC Saturday, 1 October. Later that day the problem apparently recurred since Mode B failed to appear as scheduled at about 2047 UTC when it again passed MA 40.

The M-Block above also confirms discussions held earlier in the week concerning full-period Mode B and new Mode L operating times. Full-period Mode B should begin on Monday, QRP day, on 3 October. The full-period operation is entered as an experiment, according to W3GEY, since the performance during the perigee period is expected to be poor. The poor performance will be attributable, ASR is told, to the antenna angle, the fact that the 2-meter omni may be bent and the high degree of spin-QSB resulting. Nevertheless, Mode B should be on for all the time that Mode L is off. As also disclosed above, Mode L will now be heard on Saturday apogees as well bringing the total of Mode L operations to an average of 8 hours per week. (2 hours per apogee on Wednesdays and Saturdays with 2 apogees per day, approximately.) The ratio of B/L would then be about 21:1. That ratio is expected to reflect Mode B and Mode L traffic levels with Mode L's enormous 800 kHz band-pass serving as a safety valve against heavy Mode B traffic. With the improvements in the Mode L sensitivity noted in a related story in this issue, many new stations are expected to populate the new turf on 1269 MHz.

The Mode-B shutdown has ASR office phones and the phones of AMSAT officials the focus of dozens of concerned callers. All wanted to know if the trouble were serious and how "their bird was fairing."

W8DX, the satellite veteran-of-veterans called ASR from Detroit in obvious distraught condition seeking assurances that AO-10 was alive and well. W4BIW opined that he hoped AO-10 weathered the present situation well "'cause I don't feel like setting up EME antennas in the yard" apparently alluding to EME being the only remaining challenge and he'd much rather have fun with

man-made satellites than the natural kind (the moon)!

ASR expects that by next issue additional light will be shed on the topic of the unscheduled Mode B shutdown. Meantime, stay tuned to the AMSAT nets for late word and any possible schedule revisions that may occur.

Late info suggests shutdown due to conjunction of eclipse with seasonal high temperatures. Voltage trip-point reduced from 13.0 to 12.0 Vdc. No damage to spacecraft has occurred.

Mode L Down (But Not Out)

Initial in-orbit tests of AO-10 Mode L (24 cm up, 70 cm down) on 21 Sept. were disappointing according to several who participated. Opening day for Mode L found scores of anxious UHFers perched on their seats ready to pounce. Although both the General and Engineering Beacons came on and were monitored at their anticipated, strong levels, signals from the Mode L transponder were extremely weak or entirely absent. Initial estimates placed the levels at least 20 dB below anticipated. Those stations heard were found to have prodigious amounts of RF at their disposal.

Apparently it required all that could be mustered from an amateur station to produce a usable signal on the 70-cm downlink. Several stations were producing in excess of 40 dBW EIRP (10,000 watts effective isotropic radiated power). That was a far cry from the 30 dBW (1000 watts) EIRP expected to produce usable downlinks. What had happened?

AMSAT technical managers in Germany and the U.S. quickly ascertained that the Mode L transmitter appeared normal. The nominal signal strength of the beacons was clearly an index to a good transmitter. Attention focused on two areas primarily: the Mode L receiver and the Mode L antennas. Each was suspected as the potential culprit because of prior difficulties.

The Mode L receiver was a possible malfunction locus. It had failed during a thermal vacuum test at the Goddard Space Flight Center the first week in June, 1982 (See ASR #35, June 14, 1982). Could a similar failure have occurred?

The Mode L antennas were the next suspect. After the collision with the Ariane launcher 52 and 55 seconds subsequent to deployment it was learned that the 2 meter high gain array had been deformed. Could the 24 cm helix have been zapped as well?

Several observable facts argued strongly against the "Broken/Bent Antenna" theory. The signals that were transponded, although weak, were very steady in amplitude; no discernable QSB above a dB. It would be hard to imagine a broken or bent helix showing that degree of circularity opined VP Engineering W3GEY.

That left the L-receiver and a few other possibilities to be looked at. One of the other possibilities concerned the function of an antenna switching relay in the Mode L

receive circuit. It was designed to select between the 24 cm helix and the 24 cm turnstile. The relay, a sophisticated transfer relay of aerospace quality made by Transco, was evaluated since among possible failure points it had the best chance of being the culprit. That's because, reliability engineers point out, the MTBF (Mean Time Between Failures) of a relay might be an order of magnitude less than a solid state circuit (such as the Mode L receiver) when the latter is operated at low (electrical) stress levels. For example, it's obvious that a 1 watt resistor dissipating 5 microwatts should last a lot longer than a similar one running 900 milliwatts! The same holds for transistors. The Mode L receiver is designed with low stress levels to increase the MTBF to the order of years. But relays are a different story. Though simple in principle, they often play havoc with reliability requirements.

Because the relay seemed to be the most logical failure point, DJ4ZC and colleagues decided that it might help to cycle the relay through a few engagement-disengagement sequences. If it were stuck, it was reasoned, the sequencing might "un-stuck" it.

On the next Mode L schedule beginning one hour before the 15:09 UTC apogee on 28 Sept., the relay activation and cycling was performed. Apparently it had a therapeutic effect for thereafter the signal levels were up considerably. In fact, DJ4ZC stated after the tests that now the signal levels had improved such that they were down by only 10 dB. He concluded that there was in fact some problem with the antenna relay.

While there was no reason for optimism earlier in the week and it appeared only the very powerful, EME-class stations would be able to use Mode L, now there WAS room for hope. Use of Mode L was approaching the region of "ordinary" well-equipped UHFers, that is something less than 40 dBW. Now the optimism is based on doing more of the same. If a few cycles of the relay did some good, more cycling should do more good, the logic seems to indicate. Right? Maybe!

In examining relay failure modes several possibilities have been discussed. These tend to cluster about the various nasty things that happen in objects in space: heat, cold, vacuum, radiation and in our case, unanticipated physical jolts. Or had the relay been defective before launch?

As is apparent, there remain more questions than firm answers. What is known *does* give reason for hope that this latest episode in the unfolding drama will have a happy ending.

Whether the malady is the result of relay insulation outgassing (RTV, polyethylene, PVC or the like) film deposition on the contacts or some other more mechanically-based malfunction, the tale shall be told in the next week or two. By then new relay-exercise software will attempt to clear the malfunction by further application of the prior therapy. The Amateur world again holds its breath while the technical managers match wits with AO-10, Nature and "Murphy" to get to the bottom of yet another Phase III side-trip-surprise. But then, one needs reflect that this REALLY IS new territory we're in and we shouldn't be too surprised...when we're surprised!

AMSAT Elections

The following platform statements are made by candidate Directors.

Statement of Candidate John Browning, W6SP

I will continue my enthusiastic support for the following important AMSAT activities.

1. Perpetuation of a climate which encourages progress by the small teams of extremely talented and dedicated individuals who are directly responsible for the remarkable achievements in amateur satellite development.
2. Establishment of a reasonable balance between technical advancement and operational utility for future spacecraft.
3. Promotion of new fund raising activities, both large and small.
4. Maintenance of a policy of transparency with regard to international politics to permit members who so choose to avail themselves of our unique opportunities for improving international relations through world-wide, person-to-person, amateur satellite communications.
5. Improvement of all membership services.

Statement of Candidate Jan King, W3GEY

I feel AMSAT has some difficult decisions ahead. I will try to provide a historical perspective toward those issues which face us. Given my available time I will assist in setting new technical goals for the organization that are in balance with user needs and the objectives of the organization as stated in our articles of incorporation.

Statement of Candidate John Henry, VE2VQ

Not received at press time.

Statement of Candidate Wray Dudley, W8GQW

Providing dedicated assistance to the continuing development and growth of a vital AMSAT would be the top priority as a member of the Board of Directors.

Accomplishment of this effort is obviously multifaceted and would include bringing to the deliberations of this body the experience gained in a professional career of operations and management in private industry.

In specific areas, though not all inclusive, the following subjects for consideration:

- a) A recommendation that the membership be kept fully informed of our on-going financial situation and a detailed annual financial report be published.
- b) Examine and investigate thoroughly all projects requiring major expenditure of funds and man-power.
- c) Develop alternative methods of realizing active involvement of more members in the operation of the organization.
- d) Provide a check and balance on activities which could adversely affect the excellent name and reputation of AMSAT.

e) Endeavor to further enhance the relationship of AMSAT-US and our associated groups worldwide.

f) Establish a future planning committee to carefully review and evaluate proposed projects and organizations with whom we might associate and provide our unequaled expertise in the realm of amateur space activity.

Statement of Candidate John Pronko, W6XN

As with any corporate entity, it is the responsibility of the AMSAT Board of Directors to represent the members of the organization who are scattered over a large geographical area. The Board should see to it that the officers are provided with a well thought out and sound operational directive. AMSAT is entering a very critical period. After the successful launch of its long planned Phase-III satellite and the paucity of new launch opportunities it is now faced with new decisions regarding the direction to take with its future programs and resources. With the desire by some officers who have given of themselves so graciously and well, to step down or otherwise curtail their involvement to some reasonable level, it is especially critical that the Board members give to the new officers and volunteers the proper direction to which to set the rudder and sails of this great organization. I believe it is imperative that AMSAT continue its lead position in the Amateur Satellite Service and act as co-ordinator of international efforts. The many centers of excellence and national groups should be encouraged to play greater roles in satellite construction. I feel that AMSAT should continue to support the pursuit of state-of-the-art space communication technology as well as new satellite concepts and provide the user community the necessary member service for optimum use of these satellites when that service is not available from other organizations.

Statement of Candidate John Montague, WØRUE

During the past several years our organization has devoted nearly all its energies and resources to the creation of AMSAT-OSCAR 10. The rigors of this fabulous accomplishment have necessitated several actions that taxed financial and organizational health. As we developed Phase-III few new members strengthened our ranks and the treasury was, despite many innovative fund raising efforts, reduced to an uncomfortable level. Satellites and associated activities are very costly. The reserve fund created by the excess in the Life-Member fees has been borrowed from, for the good of all members (funding AO-10); this fund must now be repaid, by all the members.

Second, member participation and input have been less than optimum. As we set new goals for AMSAT, closer communication must occur between the members and officers/directors who carry-out their wishes. We must recognize that our officers and other volunteers have put in more time and effort, at much personal sacrifice, than most of us realize. Now the demands of AO-10 are past more time can be devoted to member discourse. But, to be effective members will have to make the effort to state their views to their representatives, an action that many seem willing to take only

after an event occurs with which they are displeased. Every member must take the initiative and participate in every way that they can, at the very least by regularly voicing their views. Thus will we set our future course -the health of AMSAT depends on new ideas, new voices, new active participants.

Statement of Candidate Jack Colson, W3TMZ/W3OZ

Having been a member of AMSAT since 1971 I believe that I understand a bit of our history. My objectives for AMSAT are to continue creating interesting and challenging semi-professional endeavors for the amateur radio community. I believe that the next few years are going to be hard, the organization has a lot of problems that must be addressed. Several of the most major problems are: 1) to identify new hardware oriented personnel who can take on specific projects and see them through to completion, 2) find suitable launch opportunities and 3) to improve the volunteer aspects so vital for the future health and growth of AMSAT. My goals are to work to the objectives of the Board of Directors and the General Manager keeping our past in mind. Moreover, to keep our objectives within our financial means and to act as a communicator between people.

Short Bursts

- A new video tape about packet radio featuring Pete Eaton, WB9FLW, is now available. The program was professionally taped at Pete's presentation to the Central Iowa Technical Society. This might be just the ticket for a showing at your club with all the current interest in packet Radio. The one-hour program tape is available for sale from the Society for \$25, postpaid. Send to CITS, c/o WØRPK, RR 4, Indianola, IA 50125 or call 515-961-6406.
- According to G3YJO, UoSAT-B will be launched in February 84. The extremely short-fused project has left little time for development and the main idea seems to be to build as quickly as possible to take advantage of the launch opportunity. More on this later.
- A new version of the W3IWI program for the Atari (minimum 16K) is now available from the AMSAT Software Exchange. The conversion to Atari BASIC was done by W7KKE/4 with help from N4QQ. It's available for \$15 in either cassette or diskette format. Write the AMSAT Software Exchange care of AMSAT, P.O. Box 27, Washington, DC 20044.
- In ASR #63 we left out a couple of symbols in a "patch" to the AMS-81 suggested by WØRPK. The updates should have read:
1750 IF LP > U20 AND GO = U3 THEN GOTO HD2
2020 IF LP < U20 [rest of line unchanged]
2105 LET GO = U

Net Manager W8GQW Announces Changes, Additions

AMSAT Net Manager Wray Dudley, W8GQW, has announced that Bob McGwier, N4HY, of Providence, RI, will join the team of Net Control Stations. Bob is at Brown University in Providence. His first tour of duty on the 20/15 meter nets will be on 2 October. Welcome aboard, Bob!

In other activity on the nets, W8GQW announces the popular SEASAT net based in central Florida has moved its operations to an Orlando repeater, W4OHL/R. The net will meet each Wednesday evening at 8 P.M. local time. The frequency is 146.70 with standard offset. This net formerly operated on 40 meters but poor propagation combined with QRM motivated the change according to SEASAT NCS WB4ZXS.

Similarly, Bud Schultze, W6CG, has decided to move the AMSAT Southwest Pacific Net to 15 meters. Bud cites declining conditions on 28.878 MHz as the key to this change. The net will continue to convene at 2200 UTC Saturdays but will now occupy 21.280, the standard AMSAT 15 meter frequency. Additionally, Bud will occasionally transmit this net on AO-10 on the ACNF (AMSAT Calling and Net Frequency), 145.957 MHz. He hopes to attract stateside check-ins as well as the prime-targeted ZL-VK-Western Pacific zone.

W8GQW explains that these nets are part of a worldwide system of AMSAT nets which seeks to bring the latest amateur space news to interested individuals. A comprehensive net listing appeared in ASR 48/49, 27 Dec. 82.

Member Recruitment Drive Broadens

With two months down and four to go, the AMSAT member recruitment contest is picking up steam. Dozens of new members have been signed for credit towards the fabulous FT-726R prize offered the top recruiter (See ASR 58/59, pg. 6). Word from AMSAT HQ is that the leader, with 8 signed up, is still within reach for a while. The hamfest season runs through September to early October leaving more than a month for recruiting at these activities before the club circuit must be used to find new recruits. As expanded in ORBIT #14, AMSAT is now offering additional prizes for signing up as few as JUST ONE new member. Check ORBIT #14, page 28, for details.

On related matters, President W3IWI has been soliciting opinions regarding the desirability of introducing new classes of membership with special status afforded "Sustaining Members". The new class of member would be eligible for special tokens/premiums AMSAT has developed in recent months to promote donations.

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